

Comparing Traditional Maps with Twitter-Derived Maps: Exploring
Differences and Similarities

Original

Comparing Traditional Maps with Twitter-Derived Maps: Exploring Differences and Similarities / Pensa, Stefano; Masala, Elena. - ELETTRONICO. - (2016), pp. 331-336. (Intervento presentato al convegno INPUT 2016 tenutosi a Torino nel 14-15 settembre 2016).

Availability:

This version is available at: 11583/2657677 since: 2016-11-30T11:28:06Z

Publisher:

SiTI - ISMB - Politecnico di Torino

Published

DOI:

Terms of use:

openAccess

This article is made available under terms and conditions as specified in the corresponding bibliographic description in the repository

Publisher copyright

default_conf_editorial [DA NON USARE]

-

(Article begins on next page)

INPUT 2016

9th International Conference
on Innovation in Urban
and Regional Planning



e-agorà | e-ayopà

for the transition toward resilient communities

edited by G. Colombo | P. Lombardi | G. Mondini



9th International Conference on Innovation in Urban and Regional Planning

e-agorà/e-ἀγορά for the transition toward resilient communities

Conference Proceedings Book

ISBN 978-88-9052-964-1



POLITECNICO
DI TORINO



UNIVERSITÀ
DEGLI STUDI
DI TORINO



Dipartimento Interateneo di Scienze, Progetto e Politiche del Territorio

INPUT 2016 “e-agorà/e-ἀγορά for the transition toward resilient communities”

Conference Proceedings from the INPUT2016 Conference in Turin (14th–15th September 2016)

INPUT2016 CONFERENCE COMMITTEE

Arnaldo Cecchini, University of Sassari
Dino Borri, Polytechnic University of Bari
Valerio Cutini, University of Pisa
Alessandro Plaisant, University of Sassari
Giovanni Rabino, Polytechnic University of Milan
Giuseppe Las Casas, University of Basilicata
Michele Campagna, University of Cagliari
Andrea De Montis, University of Sassari
Corrado Zoppi, University of Cagliari
Romano Fistola, University of Sannio
Rocco Papa, University of Naples “Federico II”
Patrizia Lombardi, Politecnico di Torino
Giovanni Colombo, ISMB Istituto Superiore Mario Boella
Giulio Mondini, SiTI Higher Institute on Territorial Systems for Innovation

INPUT2016 ORGANISING COMMITTEE

Cristiana D'Alberto, ISMB Istituto Superiore Mario Boella
Maria Cristina Longo, SiTI Higher Institute on Territorial Systems for Innovation
Stefania Mauro, SiTI Higher Institute on Territorial Systems for Innovation
Luisa Montobbio, Politecnico di Torino
Cinzia Pagano, Politecnico di Torino

Edited by Giovanni Colombo (ISMB Istituto Superiore Mario Boella), Patrizia Lombardi (DIST - Politecnico di Torino), Giulio Mondini (SiTI Higher Institute on Territorial Systems for Innovation)

Editorial coordination by Stefania Mauro

Graphic design by Sara Oggero (ISMB)

ISBN 978-88-9052-964-1

INPUT2016 SCIENTIFIC COMMITTEE

Ivan Blečić, University of Cagliari
Dino Borri, Polytechnic University of Bari
Grazia Brunetta, Politecnico di Torino
Edoardo Calia, ISMB Istituto Superiore Mario Boella
Domenico Camarda, Polytechnic University of Bari
Michele Campagna, University of Cagliari
Alessandra Casu, University of Sassari
Arnaldo Cecchini, University of Sassari
Giovanni Colombo, ISMB Istituto Superiore Mario Boella
Grazia Concilio, Polytechnic University of Milan
Tanja Congiu, University of Sassari
Valerio Cutini, University of Pisa
Andrea De Montis, University of Sassari
Giovanna Fancello, Paris-Dauphine University
Romano Fistola, University of Sannio
Sabrina Lai, University of Cagliari
Giuseppe Las Casas, University of Basilicata
Federica Leone, University of Cagliari
Sara Levi Sacerdotti, SiTI Higher Institute on Territorial Systems for Innovation
Patrizia Lombardi, Politecnico di Torino
Giampiero Lombardini, Università degli Studi di Genova
Enrico Macii, Politecnico di Torino
Fabio Manfredini, Polytechnic University of Milan
Stefania Mauro, SiTI Higher Institute on Territorial Systems for Innovation
Giulio Mondini, SiTI Higher Institute on Territorial Systems for Innovation
Eugenio Morello, Polytechnic University of Milan
Beniamino Murgante, University of Basilicata
Silvie Occelli, IRES Piemonte
Andrea Pacifici, ISMB Istituto Superiore Mario Boella
Rocco Papa, University of Naples “Federico II”
Paola Pittaluga, University of Sassari
Alessandro Plaisant, University of Sassari
Giovanni Rabino, Polytechnic University of Milan
Bernardino Romano, Università degli Studi dell'Aquila
Marco Santangelo, Politecnico di Torino
Francesco Scorza, University of Basilicata
Matteo Tabasso, SiTI Higher Institute on Territorial Systems for Innovation
Valentina Talu, University of Sassari
Andrea Trunfio, University of Sassari
Andrea Vesco, ISMB Istituto Superiore Mario Boella
Angioletta Voghera, Politecnico di Torino
Corrado Zoppi, University of Cagliari

Table of Content

INPUT 2016 is the ninth meeting with the name INPUT 10

Arnaldo Cecchini

INPUT 2016 “e-agorà/e-ἀγορά for the transition toward resilient communities” 11

Giovanni Colombo

STeHeC - Smart Territories and Healthy Cities 12

The role of urban cyclability in promoting public health13

Stefano Capolongo, Lorenzo Boati, Maddalena Buffoli, Marco Gola, Alessandra Oppio and Andrea Rebecchi

Social inclusion and use of equipped public space for physical activity. Analysis and promotion prospects19

Rossella Maspoli

Beyond geospatial visualisation: maps for health research25

Enrico Cicalò

Urban Form from the Pedestrian Point of View: Spatial Patterns on a Street Network32

Alessandro Araldi and Giovanni Fusco

3D Modelling from Urban Environment to Internal Management of Buildings39

Maurizio Minchilli, Elena Carta, Barbora Slabeciusová and Loredana Tedeschi

Appropriate Technologies and Deprived Neighbourhoods: Making Technologies Work for Inclusive Urban Development46

Arnaldo Cecchini, Valentina Talu and Andrea Vesco

Planning, managing and empowering while pursuing change: integrating community map-making and geographic information technologies52

Barbara Dovarch

Flexible Design to Territory Smart User-Centered60

Cristiana Cellucci and Daniela Ladiana

Integrated Accessibility: a Macro-Requirement for the Healthy City65

Filippo Angelucci and Michele Di Sivo

Environment – Cities – Users: a multidisciplinary approach for the quality of urban spaces71

Angela Giovanna Leuzzi, Roberta Cocci Grifoni, Maria Federica Ottone and Enrico Prenna

Walk, See, Know: Modelling Landscape Accessibilities77

Enrico Cicalò, Arnaldo Cecchini, Nada Beretic, Roberto Busonera, Dario Canu and Andrea Causin

Recording, management and returning of data for improving accessibility of public spaces by involving users83

Ilaria Garofolo, Elisabeth Antonaglia and Barbara Chiarelli

Multilevel Infrastructures89

Claudia Di Girolamo

The built environment as a determinant of the public health. An epidemiological survey of the walking behavior in Sardinia93

Marco Dettori, Andrea Piana and Paolo Castiglia	
<i>Shaping urban pedestrian mobility involving users: the Labac case study</i>	98
Barbara Chiarelli, Silvia Grion and Ilaria Garofolo	
<i>Spatial image of territories. The case study of Sardinia</i>	102
Miriam Mastinu	
<i>An Empirical Study on Factors of Perceived Walkability</i>	108
Ivan Blečić, Dario Canu, Arnaldo Cecchini, Tanja Congiu, Giovanna Fancello and Giuseppe Andrea Trunfio	
<i>GPS Traking and Surveys Analysis of Tourists' Spatio-Temporal Behaviour. The case of Alghero.</i>	114
Ivan Blečić, Dario Canu , Arnaldo Cecchini, Tanja Congiu, Giovanna Fancello and Giuseppe Andrea Trunfio	
<i>Triggers of urban innovation. The Case of Cavallerizza Reale in Turin</i>	121
Roberta Guido	
<i>No more build, but regenerate and reuse</i>	128
Cristiana Cellucci and Daniela Ladiana	
<i>A Reflection on Smart Governance in the new Metropolitan City of Cagliari</i>	135
Chiara Garau, Ginevra Balletto and Paola Zamperlin	
<i>R&S.U.E Resilient & Safe Urban Environment</i>	143
Ester Zazzero	
<i>Planning for S.M.A.R.T. (Specific, Measurable, Achievable, Resilient, Time-bound) development: a bottom up approach to lead knowledge-based tourism development in low density rural districts</i>	151
Tanja Congiu, Maurizio Napolitano and Alessandro Plaisant	
<i>Urban intersections effect on pedestrian accessibility</i>	157
Ivan Blečić, Arnaldo Cecchini, Tanja Congiu, Dario Canu and Giovanna Fancello	
<i>Built environment and health inequalities: results from a European research project and overview of methods for assessing health impacts in urban areas</i>	164
Enrico Eynard, Giulia Melis and Matteo Tabasso	
ESSP - Ecosystem Services and Spatial Planning	170
<i>Graph Representations of Site and Species Relations in Ecological Complex Networks</i>	171
Gianni Fenu and Pier Luigi Pau	
<i>Conflictual issues concerning land uses related to ecosystem services under the provisions of the Habitats and Birds Directives</i>	177
Federica Leone and Corrado Zoppi	
<i>Assessment: land use and capacities to provide ecosystem service. The case study of Tertenia</i> ..	184
Maddalena Floris	
<i>The Natura 2000 Network in the context of the Metropolitan City of Cagliari: an example of Habitat Suitability Approach (part one)</i>	190
Daniela Ruggeri and Ignazio Cannas	

<i>The Natura 2000 Network in the context of the Metropolitan City of Cagliari: an example of Habitat Suitability Approach (part two, continued from part one)</i>	196
Ignazio Cannas and Daniela Ruggeri	
<i>Ecosystem services within the appropriate assessment of land-use plans: exploring a potential integration</i>	202
Sabrina Lai	
<i>Courtyards, Climate regulation services and Nature-based solutions: a modelling approach to support urban regeneration of empty spaces</i>	208
Raffaele Pelorosso, Federica Gobattonia, Francesca Calace and Antonio Leone	
TSC - Towards the Smart City	213
<i>A critical review of parameters within urban sustainability models: how much do soil and natural resources weight?</i>	214
Floriana Zucaro	
<i>The building aspect ratio for an energy efficient green network design</i>	220
Carmela Gargiulo and Andrea Tulisi	
<i>Energy efficiency measures for building and their impact on the grid in a Middle East case study</i>	226
Paolo Lazzeroni, Sergio Olivero, Federico Stirano, Guido Zanzottera, Carlo Micono, Piercarlo Montaldo and Umberto Fabio Cali	
<i>Energy consumption in hospitals: towards a new benchmark</i>	231
Romano Fistola and Marco Raimondo	
<i>Urban Environmental Quality and Sustainability: a proposal for an evaluation method of Neighborhood Sustainable Assessment tools</i>	238
Rocco Papa, Chiara Lombardi and Maria Rosa Tremitterra	
<i>DIPENDE – a tool for energy planning of building districts based on energy performance certification data</i>	245
Ezilda Costanzo, Bruno Baldissara and Marco Rao	
<i>Energy Efficiency and Participation: a double smart approach in LEO project</i>	251
Cristina Marietta, Giulia Melis and Maurizio Fantino	
<i>Identify the sustainable level of local plans and urban sectors. Proposal for an operational procedure</i>	258
Giuseppe Mazzeo	
<i>Key Messages: a decision support system based on the integration between city and mobility</i> ..	264
Carmela Gargiulo and Maria Rosa Tremitterra	
<i>Accessibility and built environment surrounding metro stations: a GIS-based comparison of Naples line 1, Milan line 3 and London Jubilee line</i>	269
Rocco Papaa, Gerardo Carpentieria and Gennaro Angiello	
<i>A GIS-based and socially participative procedure for the location of high vulnerability territorial functions</i>	275
Romano Fistola and Rosa Anna La Rocca	

<i>Modelling and Assessing Pedestrian Isochrones around Public Transport Nodes: a People-Centred Perspective towards Smartness</i>	281
Silvia Rossetti, Michela Tiboni and David Vetturi	
<i>Households' willingness to pay in good and bad economy. The case study of Naples</i>	287
Carmela Gargiulo, Simona Panaro and Laura Russo	
SMGI - Social Media Geographic Information and collaborative mapping: exploring new trends in spatial analysis	294
<i>Social Media Geographic Information Visual Analytics</i>	295
Junia Borges, Ana Clara Moura, Priscila de Paula and Pedro Casagrande	
<i>Beyond social networks contents: how Social Media Geographic Information may support spatial planning analysis</i>	300
Pierangelo Massa, Roberta Floris and Michele Campagna	
<i>Social Media Geographic Information for urban space analysis: the case of Expo Milano 2015</i>	307
Raffaele Gallo, Michele Campagna, Pierangelo Massa and Giovanni Rabino	
<i>The use of SMGI in supporting tourism planning practices: an innovative approach for the municipality of Cagliari</i>	313
Roberta Floris, Pierangelo Massa and Michele Campagna	
<i>Real society in virtual space: a new platform to share responsibilities</i>	319
Lucia Lupi, Alessio Antonini, Guido Boella and Eloheh Mason	
<i>Online tools for public engagement: case studies from Reykjavik</i>	325
Iva Bojic, Giulia Marra and Vera Naydenova	
<i>Comparing Traditional Maps with Twitter-Derived Maps: Exploring Differences and Similarities</i>	331
Stefano Pensa and Elena Masala	
<i>Mapping the food system in Turin</i>	337
Luca Davico, Marina Bravi, Egidio Dansero, Gabriele Garnero, Paola Guerreschi, Federico Listello, Giacomo Pettenati, Paolo Tamborin and Alessia Toldo	
<i>Crowdmap applied to Geotourism: Case Study of Chapada Diamantina BA - Brazil</i>	344
Pedro B. Casagrande, Nicole Rocha, Priscila Lisboa and Ana Clara Mourão Moura	
<i>MiraMap: an e-participation tool for Smart Peripheries</i>	350
Francesca De Filippi, Cristina Coscia, Guido Boella, Alessio Antonini, Alessia Calafiore, Anna Cantini, Roberta Guido, Carlo Salaroglio, Luigi Sanasi and Claudio Schifanella	
<i>Production of spatial representations through collaborative mapping. An experiment</i>	356
Angioletta Voghera, Rossella Crivello, Liliana Ardissono, Maurizio Lucenteforte, Adriano Savoca and Luigi La Riccia	
UFEP - Urban Form and Perception of the City	362
<i>THE FRIENDLY CITY [LA CIUDAD AMABLE]. Andalusian Public Space Programme Awareness raising, training and interventions regarding cities, public space and sustainable mobility</i>	
363	

Gaia Redaelli

Space Syntax applied to the city of Milan370

Valerio Cutini, Denise Farese and Giovanni Rabino

Configurational Approaches to Urban Form: Empirical Test on the City of Nice (France)376

Giovanni Fusco and Michele Tirico

Physical factors affecting the citizens' security feeling in communal spaces (case study: BandarAbbas city)383

Ali Shahdadi and Marziyeh Rezanejad

Conurbations and resilience. When growth makes us fragile389

Valerio Cutini

IMPC – ICT Models: Planning for inclusive Communities395

Virtual Environments as a Technological Interface between Cultural Heritage and the Sustainable Development of the City396

Georgios Artopoulos

Visualisation Tools in Grasshopper+Rhino3D to Improve Multi-Criteria Analysis in Urban Policies – Case Study of Pampulha, Brazil404

Ana Clara Mourão Moura, Suellen R. Ribeiro, Diogo C. Gualdalupé and Silvio R. Motta

Studies of Volumetric Potential in Pampulha, Brazil411

Suellen R. Ribeiro and Ana Clara Mourão Moura

When the parametric modeling reveals a collapse in the future urban landscape: The case of Divinópolis – Minas Gerais/Brazil418

Diogo de Castro Guadalupe, Bruno Amaral de Andrade and Ana Clara Mourão Moura

A Spatial Decision Support System for Industrial Re-Use424

Alessia Movia and Maria Vittoria Santi

How knowledge subjectivity affects decision-making: a Geodesign case study for the Cagliari Metro Area429

Elisabetta Anna Di Cesare, Roberta Floris and Michele Campagna

Knowledge Organization for Community Revitalization: An Ontological Approach in Taranto Industrial City436

Rossella Stufano, Dino Borri, Domenico Camarda and Stefano Borgo

Integrating VGI system in a Participatory Design Framework441

Alessia Calafiore, Junia Borges, Ana Clara Mourão Moura and Guido Boella

Evaluation of social benefits generated by urban regeneration: a stated preference approach 447

Marta Bottero and Giulio Mondini

URTL - Urban-Rural Transitional Landscapes453

Urban-rural-natural gradient analysis using CORINE data: an application to the Italian regions of Friuli Venezia Giulia, Umbria, and Calabria454

Marco Vizzari, Sara Antognelli, Maurizia Sigura and Giuseppe Modica	
<i>Liveability services in transitional landscapes: a spatial-MCDA model for assessment and mapping</i>	461
Sara Antognelli and Marco Vizzari	
<i>Big data and environmental management: the perspectives of the Regional Environmental Information System of Sardinia, Italy</i>	468
Andrea De Montis, Sabrina Lai, Nicoletta Sannio and Gianluca Cocco	
<i>Quantifying transport infrastructures and settlement fragmentation: strategic measures for rural landscape planning</i>	474
Andrea De Montis, Antonio Ledda, Vittorio Serra and Mario Barra	
<i>Multi-temporal satellite imagery for soil sealing detection and urban growth mapping in the city of Ranchi (India)</i>	480
Andrea Lessio, Vanina Fissore, Barbara Drusia and Enrico Borgogno-Mondino	
<i>Temporal variation of ecological network's structure: some insights on the role of Natura 2000 sites</i>	486
Giuseppe Modica, Luigi Laudaria, Andrea De Montis, Simone Caschili, Maurizio Mulas, Amedeo Ganciu, Leonarda Dessena and Carmelo Riccardo Fichera	
<i>Reducing land take and preserving land quality. A methodology for the application of the Lombardy Regional Law</i>	493
Raffaele Sigon and Giulio Senes	
<i>GIS advanced tools for urban growth reading and management for best practices in town-planning</i>	498
Enrico Borgogno-Mondino and Barbara Drusi	
<i>The bioremediation of polluted areas as an opportunity to improve ecosystem services</i>	505
Lorenzo Boccia, Alessandra Capolupo, Elena Cervelli, Stefania Pindozzi, Marina Rigillo and Maria Nicolina Ripa	
<i>Landscape Bionomics: A Comparison Between Two Rural-Suburban Landscapes from Brussels and Milan</i>	512
Vittorio Ingegnoli, Ernesto Marcheggiani, Hubert Gulinck, Fredrik Larouge and Andrea Galli	
<i>Mapping Cilento: Visual analysis of geotagged Twitter data to study touristic flows in southern Italy</i>	519
Ernesto Marcheggiani, Alvin Chuac, Loris Servillo and Andrew Vande Moere	
<i>Association between a spectral index and a landscape index for mapping and analysis of urban vegetation cover</i>	526
Nicole A. da Rocha, Ítalo S. Sena, Bráulio M. Fonseca and Ana Clara Mourão Moura	
MMSD - Methods and Models for Sustainable Development	532
<i>Mobility Flow Estimates at Sub-Regional level: an Application to Piedmont</i>	533
Simone Landini, Sylvie Occelli	
<i>A parametric method to analyze and enhance the cultural heritage and its context</i>	538
Roberto De Lotto, Veronica Gazzola, Cecilia Morelli di Popolo and Elisabetta Maria Venco	
<i>Present State of Inbound Tourism in Japan and Factors of Destination Choice</i>	545

Akiko Kondo and Akio Kondo

A toolkit for sustainable development planning: the Val D'Agri case study551

Giuseppe Las Casas and Francesco Scorza

Indicators of resilience for Strategic Environmental Assessment557

Giampiero Lombardini

Scenarios' evaluation of territorial transformation in the province of Belluno through the application of the AHP methodology563

Giovanni Campeol, Fabio De Felice, Nicola Masotto, Antonella Petrillo and Giuseppe Stellin

INPUT 2016 is the ninth meeting with the name “INPUT”

A biennial appointment that started in 1999 in Venice at the IUAV.

We had two shifts in the conference, one in date: 2005 (Alghero) was followed by 2008 (Lecco), to avoid overlapping with the CUPUM conference (*Computers in Urban Planning and Urban Mangament*); and one in name: the acronym INPUT at the beginning stood for *INformatica e Pianificazione Urbana e Territoriale* and now it's *Innovazione e Pianificazione Urbana e Territoriale*.

I have been one of the organizer of the first meeting and I'm very proud of the results the initial intuition has yielded through the organization of this long series of conferences.

In 9 conferences all across the country (Venezia, Isole Tremiti, Pisa, Alghero, Lecco, Potenza Cagliari, Napoli, and now Torino) hundreds of experts and users had the opportunity to share ideas, experiences, tools and projects; people from academic world (among them: urban planners, architects, engineers, computer scientists, sociologists), public administration, and industry (from small start-ups to big enterprises) have had the opportunity to explore and measure the relevance of the ICT for the new ways to think and practice planning and design.

Now we have to face new challenges and maybe rethink the formula of the conference.

We know we were right because nowadays one of the most common sense and mainstream expression is “smart city” (personally I'm not fond of this expression, but it is a fact that this is an expression widely used); we know we have to change exactly for the same reason: we need to avoid the abuse of that expression that can lead to an overly technocratic approach often imbued with ideology; as usual we need to make use of the best available technologies, but having an idea of the purpose of planning, a shared vision of the future.

For this reason I am wondering if this occasion could be the moment for a step forward: from the birth of an Association, to the organisation of a seminar for young researchers and professionals (one year the biennial conference, the next year the seminar), to the opening of the conference to other disciplines (history, restoration, archaeology, ...).

The Torino conference could be the right occasion for this *shift of perspective*: among its organisers, in addition to the *Interuniversity Department of Regional and Urban Studies and Planning of the Politecnico di Torino and Università di Torino* (DIST), there are two research institutes: *Istituto Superiore on Territorial Systems for Innovation* (SiTI) and *Istituto Superiore Mario Boella on the Information and Communication Technologies* (ISBM); so that research, education, applications and projects are all brought together through the experiences of the organizing institutions: a good viaticum for the future course of INPUT.

Arnaldo Cecchini

INPUT 2016 “e-agorà/e-ἀγορά for the transition toward resilient communities”

It is universally recognised that the *Smart City* perspective raises a wide spectrum of unexplored and interdependent problems and extends the horizon over which the *City* growth strategies are defined. Energy generation and consumption models, urban mobility schemes, service processes, goods production mechanisms, citizens’ behaviour and community habits are all aspects radically challenged by this perspective. These are sufficient circumstances to affirm that the *smart and sustainable* perspective of our cities is fully inscribed in the fundamental questions of our age.

And it is exactly the character of these *fundamental questions* that makes *Smart City* an unrepeatable occasion for society to challenge on subjects of *technical, economical, territorial and societal* nature that need to be stimulated jointly if the essential aim of Smart City is really the *good life* for society. In this framework, it is fundamental that the technical discontinuities are *responsive* ahead of the unprecedented needs of a sustainable development and the financial system is *flexible* enough to support the new kinds of infrastructural solutions. The territorial and urban disciplines are singled out to elaborate *innovative* concepts enabling the completely renewed City processes to take place. The public administration systems must guarantee *effective* measures and incentives to facilitate the inevitable transformations. The societal bodies must play an essential role in increasing the level of *consciousness* and *participation* of the citizens in defining and verifying the suitability of the new social processes.

All these aspects are covered in our Input Conference, where a wide spectrum of scientific thoughts and sensibilities are brought together with the aim of creating a common and challenging perspective: an intelligent, sustainable and inclusive City as a fundamental contribution to the environmental health and the social wellbeing.

Giovanni Colombo

Comparing Traditional Maps with Twitter-Derived Maps: Exploring Differences and Similarities

Stefano Pensa^a and Elena Masala^b

^a DAD - Department of Architecture and Design, Politecnico di Torino, Torino, Italy
(stefano.pensa@polito.it)

^b SiTI - Higher Institute on Territorial Systems for Innovation, Torino, Italy
(elena.masala@polito.it)

Keywords: social media; twitter; urban planning; GIS; visual analytics.

Introduction

Nowadays, data generated by the users of ICT social media are easily available raw data, which often include a geo-information and provide lots of information on individual and collective life. This huge quantity of information is expected to offer opportunity for innovation in urban and transport planning (Bawa-Cavia 2010; Chua, Marcheggiani, Servillo and Vande Moere 2014; García-Palomares, Gutiérrez and Mínguez 2015; Hahmann, Purves and Burghardt 2014; Kokalitcheva 2014; Lanzerotti, Bradach, Sud and Barmeier 2013; Kwan 2016; Neuhaus 2011; Zachariadis *et al.* 2015). Nevertheless, the application in the planning practice presents some points of discussion. Miller and Goodchild (2015) outline how data-driven geography should consider the necessity of filtering user-generated data because of their messiness and the need for integration with other information because data have no answer for everything. In particular, they remarks that social media data are not a sample of the whole population but the whole set of data produced by a self-selected population. In order to understand how social media data can be used to integrate, or even to substitute, traditional data, this paper describes the outcomes from a comparison between traditional official maps and maps derived from the analysis of Twitter data in Pampulha, a neighbourhood of Belo Horizonte, Brazil. The comparison focuses

on land uses and transport infrastructures, considered as the basic elements for the elaboration of an urban plan.

Methodology

Available data for the case study

Pampulha is an administrative region of Belo Horizonte, Brazil, grown on the surrounding of a man-made lake built in the early 1940s. Pampulha is a neighbourhood particularly attractive for both its citizens and tourists, due to the architectures of Oscar Niemeyer, gardens by Burle Marx and paintings by Candido Portinari, but also for hosting the Universidade Federal de Minas Gerais (UFMG), the “Mineirão” Stadium, the Mineirinho Arena, the Zoo, a small airport, industrial zones, different urban gardens and a military area. This mix is resumed in the official land use map (Figure 1).

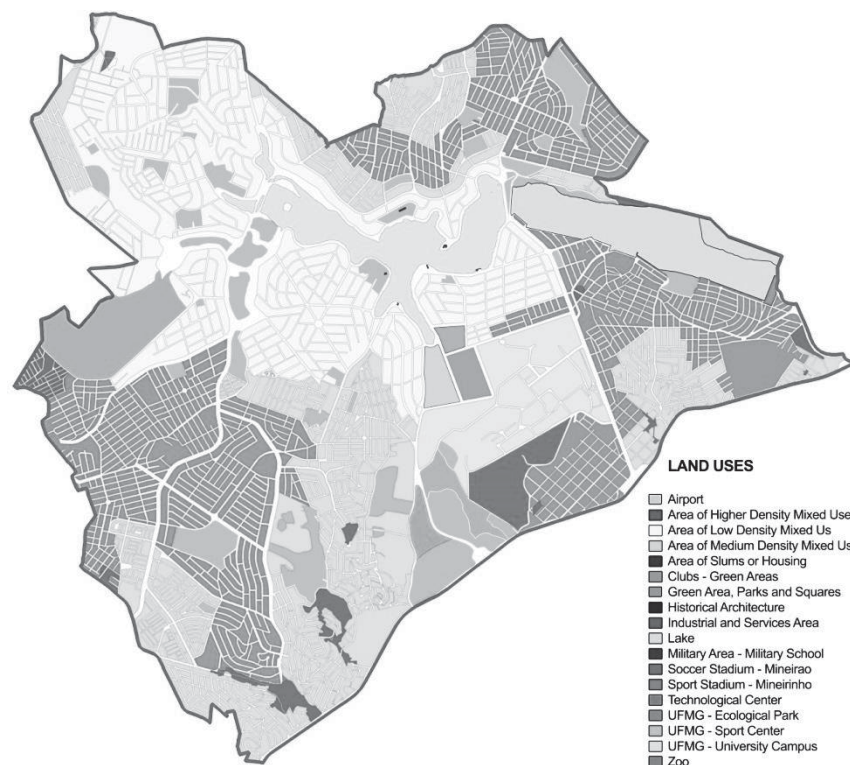


Fig. 1. Official map of land use in the area of Pampulha, Belo Horizonte, Brazil. Source: Prodabel/PBH - Municipality of Belo Horizonte, 2015.

With regards to the transport planning of the city, the official map provides information on the capacity of roads expressed in term of number of vehicles which can pass in one hour. In order to make a comparative analysis, this research makes use of Twitter data, collected between March 26th and July 22nd, 2015, from the whole metropolitan area of Belo Horizonte. Collected data are only geo-referred tweets, whose amount is 929,281 tweets sent by a total of 41,317 different users.

Methodology

The first step consisted in filtering raw data in order to obtain a reduced database containing only the tweets of users who sent almost one tweet from Pampulha neighbourhood. All following analysis were performed on this filtered database, which resulted in 42,991 tweets sent by 5,173 different users.

A second step consisted in calculating the density of tweets, which was processed by applying the quartic kernel function (Silverman 1986, p. 76, equation 4.5). Through this function, sent tweets

were grouped in areas with the same level of density. The same function was applied also to the official land-use map, providing a map showing a level of density in both the cases: density of land use for the traditional map, and density of Twitter activity for the tweet footprint map (Figure 2).

The third step consisted in elaborating a map containing the possible movements of Twitter users. Thus, data were elaborated to correlate the subsequent tweets of each single user. Physical and temporal distances between each couple of tweets were calculated in order to select only those couples which implied a movement of the user in a specific speed range.

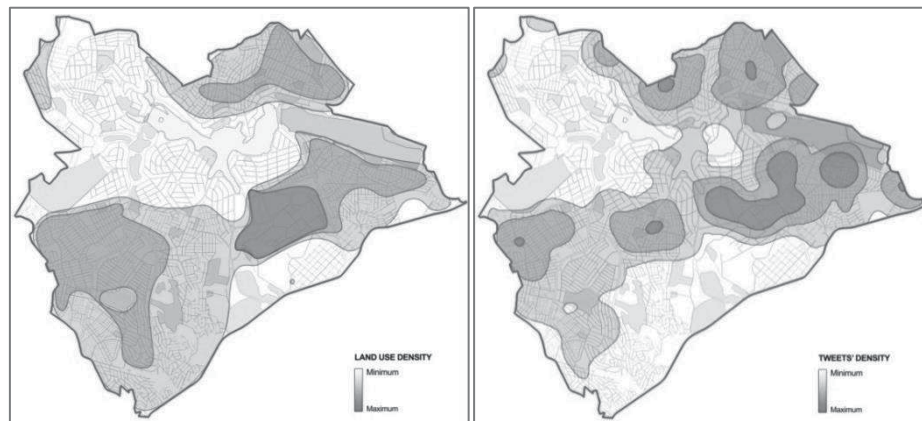


Fig. 2. Quartic Kernel function applied to the traditional land-use map (on the left) and to the footprint map of tweets (on the right).

Then, those couples were used as origin-destination points and overlapped to the actual road network as provided by MapQuest, an OpenStreetMap tool (www.mapquest.com/). Through the shortest path algorithm of the tool itself, a map was created to show the possible paths on the road network that Twitter users could have covered between two subsequent tweets (Figure 3).



Fig. 3. Application of the shortest path algorithm to the couples of subsequent tweets.

Results and discussion

The comparison between traditional map and map derived from social media data was performed on density parameter. Two main comparisons were developed, one for the land use and one for the use of transport infrastructure.

Density of land use

Land-use density map and tweet density map are both generated with the quartic kernel function on the basis of available data. The comparison was performed overlapping and subtracting the two density maps shown in Figure 2, obtaining a further map which illustrates the areas where the two maps provide different information (Figure 4, left). The overlapping of maps provides matching information for the 56% of the area (the white areas in Figure 4, left), while the 42% of area shows light differences between the two maps. A remaining 2% does not match at all (the black areas), so that a deeper investigation is required. The area with more differences of information between the two maps covers the plots of UFMG and sport facilities (Figure 4, centre and right).

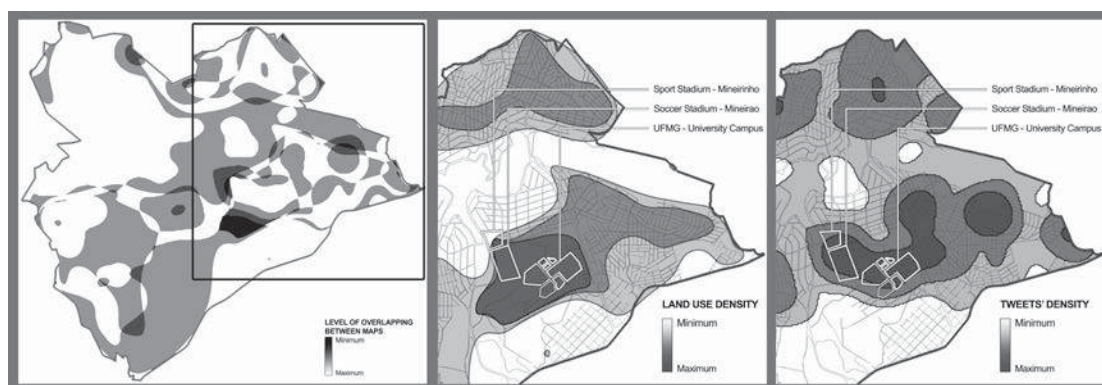


Fig. 4. On the left: overlapping of land-use density and tweet density maps: level of homogeneity of information given by the intersection of areas with the same level of density. On the centre-right: zoom on the area with more heterogeneous information: the official land-use density map (on the centre) and tweet density map (on the right).

Differences are mainly due to the nature of maps: the traditional map illustrates the building or plot density while the tweet maps show the density of (tweeting) people. The grouping mode at the basis of the maps produces different outcomes, which strongly affect both the resulting maps. For instance, the traditional map considers as a high dense area the whole area covered by the university campus, although the South-West zone of the campus is partly un-built. Something similar happens between the soccer stadium and the campus area. This is a green area that, in official maps, appears as a high dense area. The tweet density map shows more details on the use of the area than official maps, highlighting the presence of people in specific areas and offering a more actual view of the use of space. Nevertheless, official land-use map can be more reliable if the planning and decision-making processes should have to consider the possibilities for a future use of the area instead of actual one.

Density of use of transport infrastructures

The density function applied to the official map of transport infrastructures highlights the areas with more vehicles capacity, while the application of shortest path algorithm to sub-sequent tweets provides information on the possible use of road infrastructures. The overlapping of the two information sources shows consistencies when considering the tweeting traffic, which lays

on high-capacity roads, confirming the possibility for many people to pass by those roads. Nevertheless, it shows also divergences. This is the case of the three areas (A, B and C) (Figure 5), in which the high capacity of roads does not correspond to the presence of a large number of people. The roads in A and B are on the North of the lake, while C is a very large roads that goes outside Pampulha. Therefore, some considerations should be done on the use of these high capacity roads.

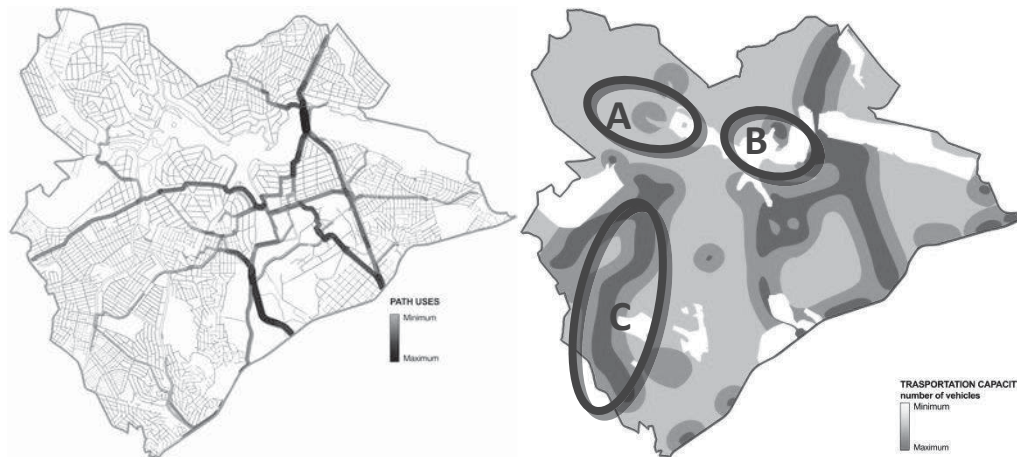


Fig. 5. Uses of paths according to the subsequent tweets, overlapped on the map of transportation capacity in term of number of vehicles per hour.

If C is a crossing road, it is possible that tweets are not representative of the traffic on that road because not sent during the crossing of the neighbourhood. In that case, the analysis should be widened in order to include all the tweets sent from the surrounding of the area. Furthermore, it should be considered as a possibility that the road in C was not usable in that period. Also in that circumstance, the tweets could not provide usable information. Third option, the high capacity is really over-estimated with respect to the need of people.

Conclusions

The comparative analysis between traditional official maps and maps generated by the analysis of Twitter data confirms the need for a strong filtering of raw data, especially to avoid simple correlations instead of cause-effect relationships (Miller and Goodchild 2015; Masala and Pensa 2016), but it shows also interesting opportunities for integrating and improving the traditional methodologies of planning and decision-making.

In particular, the use of Web social network data provides useful information on the actual use of land. Although tweets are sent by a self-selected population, they represent a mirror of a specific reality.

Finally, data do not provide unique information. This implies a stronger effort from planners and decision-makers in detecting useful information. Thus, data-driven approaches should provide data to the actors involved in the decision-making, allowing the actors to play with data in order to explore different combinations and discover correlations, cause-effects relationships and the best strategies for converting actual dynamics into elements for a well-working spatial system.

References

- Bawa-Cavia, Anil. 2010. "Sensing the Urban. Using location-based social network data in urban analysis." 1st workshop on Pervasive URban Applications PURBA '11. San Francisco.
- Chua, Alvin, Ernesto Marcheggiani, Loris Serrvillo, and Andrew Vande Moere. 2014. "FlowSampler: Visual Analysis of Urban Flows in Geolocated Social Media Data." Edited by Maria Aiello and D McFarland. International Conference on Social Informatics. Barcelona.
- García-Palomares, J, C, J Gutiérrez, and C Mínguez. 2015. "Identification of tourist hot spots based on social networks: A comparative analysis of European metropolises using photo-sharing services and GIS." *Applied Geography* 63:408-417.
- Hahmann, Stefan, Ross, S Purves, and Dirk Burghardt. 2014. "Twitter location (sometimes) matters: Exploring the relationship between georeferenced tweet content and nearby feature classes." *Journal of spatial Information Science (JOSIS)* 9:1-36.
- Kokalitcheva, Kia. 2014. «How a swarm of data is helping Chicago re-map urban life.» *Venture Beat*, 14 May. <http://venturebeat.com/2014/05/14/how-a-swarm-of-data-is-helping-chicago-re-map-urban-life/> (accessed January 12, 2015).
- Kwan, Mei-Po. 2016. «Algorithmic Geographies: Big Data, Algorithmic Uncertainty, and the Production of Geographic Knowledge.» *Annals of the American Association of Geographers* 106, 2:274-282.
- Lanzerotti, Laura, Jeff Bradach, Stephanie Sud, and Henry Barmeier. 2013. "Geek Cities: How Smarter Use of Data and Evidence Can Improve Lives." The Bridgespan Group, 12 November. <http://www.bridgespan.org/Publications-and-Tools/Performance-Measurement/Geek-Cities-Data-Improves-Lives.aspx#.VLZ9BSvF9Ks> (accessed January 13, 2015).
- Masala, Elena, and Stefano Pensa. 2016. "Detecting spatial features from data-maps: the visual intersection of data as support to decision-making." *RiUS IV*: forthcoming.
- Miller, Harvey J, and Michael F Goodchild. 2015. "Data-driven geography." *GeoJournal* 80, 4:449-461.
- Neuhaus, Fabian. 2011. "Twitter Data - Seeking Spatial Pattern." *UrbanTick*, 2 March. [http://urbantick.blogspot.it/2011/03/twitter-data-seeking-spatial-pattern.html?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed:+urbantick+\(urbanTick\)](http://urbantick.blogspot.it/2011/03/twitter-data-seeking-spatial-pattern.html?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed:+urbantick+(urbanTick)) (accessed January 09, 2015).
- Silverman, B, W. 1986. *Density Estimation for Statistics and Data Analysis*. New York: Chapman and Hall.
- Zachariadis, Vassilis, Camilo Vargas-Ruiz, Joan Serras, e Peter Ferguson. 2015.«Decoding Retail Location: A Primer for the Age of Big Data and Social Media.» *CUPUM 2015: The 14th International Conference on Computers in Urban Planning and Urban Management*. MIT, Cambridge, MA.